REPUBLIC OF THE PHILIPPINES

REGIONAL DEVELOPMENT COUNCIL
CENTRAL VISAYAS REGION

Beam Monolith

An Evaluation of the Column Footing Grade Beam Monolith Technology, A Foundation Retrofit Solution

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1. Background
   Research on the Foundationless Houses in Cebu
2. The Challenge
   Increasing Resilience to Earthquakes and Typhoons or Homes with no Foundations Challenge
3. Beam Monolith Technology
   A non-invasive, reinforced concrete footing solution
4. Evaluation
   Methodologies and outcome harvesting based on core viabilities
5. Results and Findings
   Summary of results from the core viabilities
6. Recommendations
   Beam Monolith's role in the housing ecosystem

Market Research on Foundationless Houses In Cebu Province

385 Houses surveyed and homeowners interviewed

64% had foundations laid during construction, but 44% of those required foundation retrofitting.

36% have NO FOUNDATIONS

Philippines Challenge: Increasing Resilience to Earthquakes and Typhoons for Homes with no Foundations

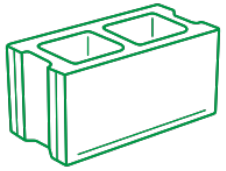
To identify **innovative** and **cost-effective solutions** for retrofitting homes with structurally unsafe or unsafe foundations, addressing **an estimated need for 1.6 million houses nationwide**.

Philippines Challenge: Increasing Resilience to Earthquakes and Typhoons or Homes with no Foundations

Innovations should demonstrate **non-invasive structural intervention**

Seismic resistance to **6.5 magnitude earthquakes** and wind resistance to **200 kph winds.**

Incremental building suitability, adaptability to **diverse soil** conditions



Compatibility with **concrete hollow block** construction

Rapid installation within **12 days**

Cost-effectiveness at Php 15,000 for a 25 m² house

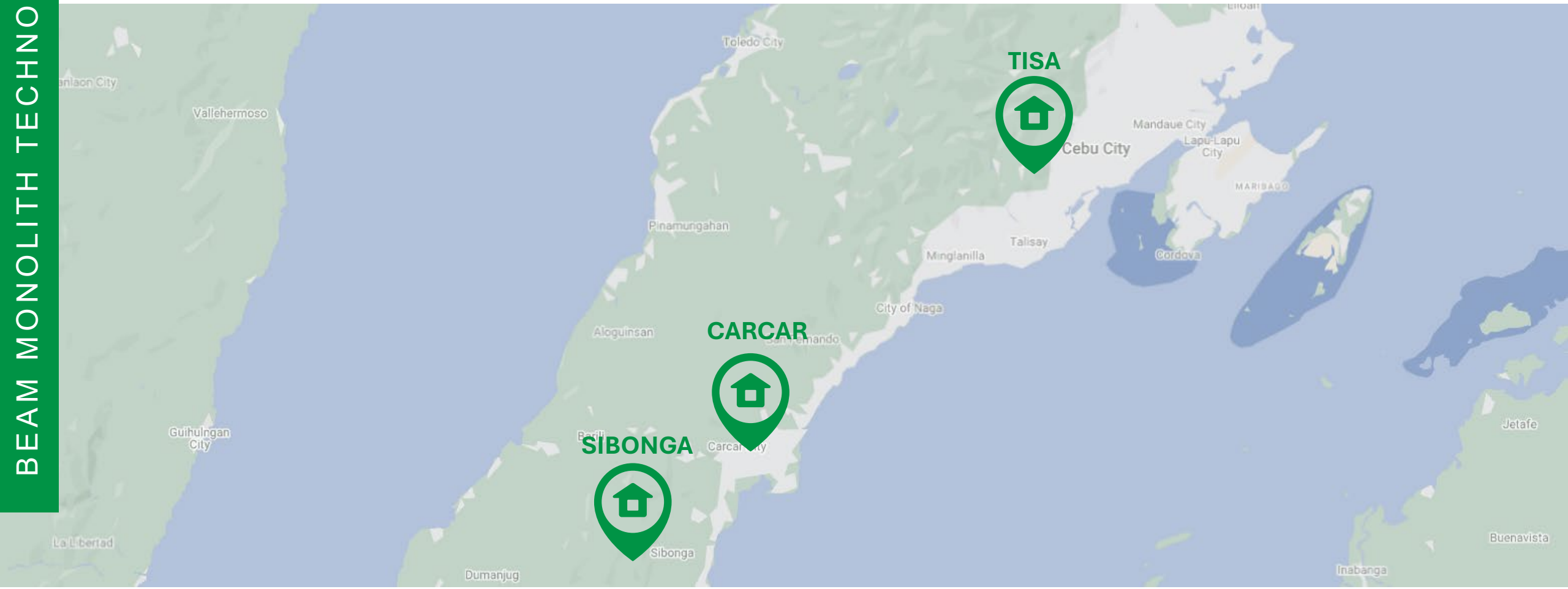
Use of readily available **local materials**

Column Footing Grade Beam Monolith Technology

- Utilizes **isolated reinforced concrete footings** positioned at each corner of the house, with a plinth beam connecting the longer side for added stability.

- **Adapts the foundation to diverse subsurface conditions** that could potentially lead to differential settlement.

PROTOTYPE LOCATIONS



6 in TISA | **2** in CARCAR | **1** in SIBONGA

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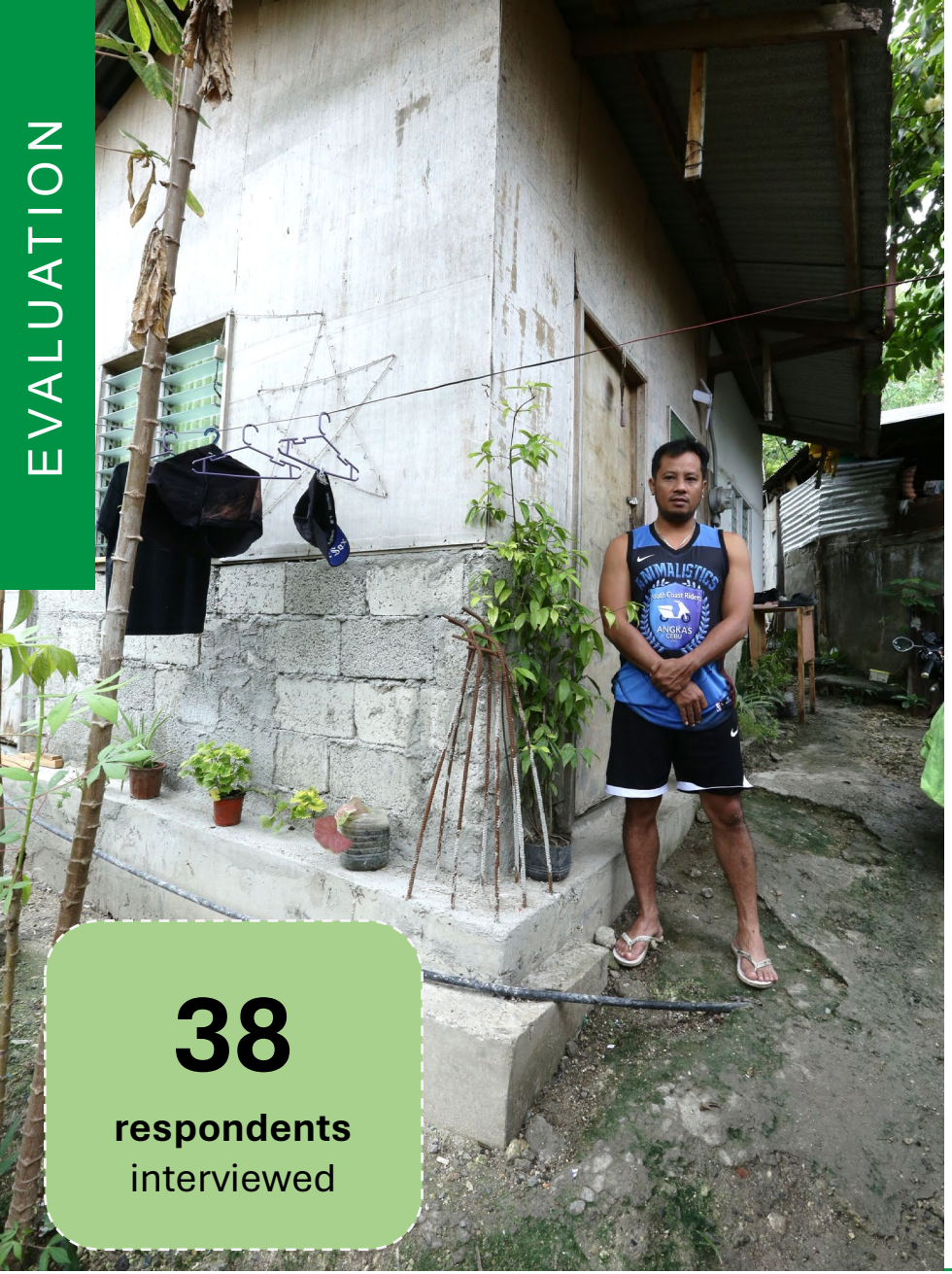
SOCIAL ACCEPTABILITY

TECHNICAL FEASIBILITY

COST EFFICIENCY

COMMERCIAL VIABILITY FOR PARTNER HARDWARE STORES



38
respondents
interviewed

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9 HOMEOWNERS

7 MASONS

21 NEIGHBORS

1 HARDWARE REPRESENTATIVE

RESULTS AND FINDINGS

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The first 6 houses retrofitted with Beam Monolith are in the urban areas of Barangay Tisa, Cebu City and the final three houses were located in the rural areas of Carcar City and Sibonga.

The solution **requires more adequate space around the houses** for the retrofitting process. **Land ownership challenges** and **specific house dimension requirements** also limited the selection of houses in the urban areas.

SOCIAL ACCEPTABILITY

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Beam Monolith received **high social acceptability** scores from interviewed homeowners, neighbors, masons, and the hardware representative.

TOP FEATURES MENTIONED:

- Ease of installation or construction
- Good material quality with local accessibility and longevity (the solution withstanding more than a 10-year lifespan)
- Durability against earthquakes and typhoons

SOCIAL ACCEPTABILITY

Column Footing Grade Beam Monolith Technology

An **overall satisfaction rate of 89%** indicated positive perceptions of the solution's durability and high-quality materials.

However, **11%** of respondents expressed **dissatisfaction due to the perceived cost and limited scope** of addressing only the house's foundation.

TECHNICAL FEASIBILITY

Column Footing Grade Beam Monolith Technology

12 Step Construction Process:

1. Site Clearing
2. Preparation for rebar cages for Column and Beam
3. Corner areas excavated to specified depths
4. Installation of rebar cages for the corner footing system
5. Drilling of anchor rods to the CHB
6. Installation of rebar cages for the grade beam
7. Pouring of Class A (1:2:4) concrete
8. Excavation for the remaining midlength along the sides
9. Drilling of anchor rods to the CHB
10. Installation of rebar cages for the grade beam
11. Pouring of Class A (1:2:4) concrete
12. Backfilling after sufficient drying and curing

TECHNICAL FEASIBILITY

Column Footing Grade Beam Monolith Technology

- **Balay Panday**, a local hardware store offering construction services, built the first six urban houses without professional supervision, leading to deviations from plans and safety hazards in five of them due to the contracted artisans neglecting to remove formwork before backfilling.

- HFHI engaged a **seasoned civil engineer** for the remaining three houses' Beam Monolith system. The Engineer worked with a local hardware company, WRJE Hardware, to supply the construction materials and provide masons for the construction of the solution.

TECHNICAL FEASIBILITY

Column Footing Grade Beam Monolith Technology

The prototypes were **completed in an average of 5 days per house** with **two to three masons** involved in each of the construction.

TECHNICAL FEASIBILITY

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The solution is **technically feasible for Cebu homes** but may not be applicable to urban areas due to adequate space restrictions.

The survey, however, garnered positive feedback from the interviewees, with the solution's technical feasibility praised for its **sturdy foundation** (able to withstand earthquakes and typhoons), **high-quality materials, and ease of vertical extension**.

COST EFFICIENCY

Column Footing Grade Beam Monolith Technology

The **average total construction cost** of the Beam Monolith System in the nine houses was **₱30,789**, which is **83% higher than the proposed budget cost of ₱16,829**.

The increase of the construction cost is mostly due to the **increase in material prices** between the proposal and implementation time.

COST EFFICIENCY

Column Footing Grade Beam Monolith Technology

While final costs exceeded the budget, interviewees expressed **willingness to pay** within their means. **86%** indicated an **ability to pay between ₱20,000 and ₱35,000** for the Beam Monolith System.

14% of respondents stated they wouldn't pay, considering foundation retrofitting a non-essential expense.

19 out of the 21 interviewed homeowners and neighbors **expressed interest in accessing financial services or products** to afford the Beam Monolith System for their foundations.

COMMERCIAL VIABILITY

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The local hardware store, particularly those who are also contractor businesses, **sees potential for profit** by offering the Beam Monolith System as a **bundled package**.

The hardware store emphasizes the **importance of educating customers about the long-term value of a solid foundation**.

COMMERCIAL VIABILITY

Column Footing Grade Beam Monolith Technology

When questioned about their marketing strategy, the hardware store's plan primarily focused on **continuing their partnership with Habitat for Humanity to serve as a contractor** for Habitat's low-income housing programs.

This approach suggests a **potential lack of understanding of the solution's broader intent** for commercial viability.

RECOMMENDATIONS

WHAT DO WE ENVISION AS NEXT STEPS?

Short-Term:
With the validation that the Beam Monolith technology is a technically viable solution, **ecosystem players can promote foundation retrofits** for houses with subpar structures to improve the resilience of houses against typhoons and earthquakes.

Long-Term:
This can be widely adopted by actors whose mandates are to help improve the structural quality and integrity of homes.

WHAT DO WE ENVISION AS NEXT STEPS?

Who can promote and adopt this solution?

Local government units, particularly rural towns and cities**, with housing plans to promote the construction of retrofit foundation for houses** with substandard quality of structure to improve the resilience of houses against typhoons and earthquakes.

NGOs, LGUs, and national **agencies that are into incremental builds and repairs with the goal** of providing safe houses for their beneficiaries or those that **provide emergency shelters that can transition to permanent housing**.

Professional associations who see importance in providing "**design for foundation first**" as a critical component to strengthen the house by offering the Beam Monolith as one of the appropriate solutions based on contextual factors.

Contractors, technical vocational institutions, information providers, hardware stores and their networks, /artisan groups, and other actors who may see the viability in taking this solution forward as an **affordable and commercial product**.

Low-Income Households looking to strengthen their houses and incrementally build with easy to install and cost-effective foundation retrofits.

WHAT DO WE ENVISION AS NEXT STEPS?

Medium-Term:
Open opportunities for other studies on foundation retrofits, using this action research on the Beam Monolith technology as a pilot reference

Who can potentially do this?

The **academe and other think tanks** who see opportunity to understand more about housing resilience and adopting, testing, and iterating this solution to a variety of housing typologies for further studies.

WHAT DO WE ENVISION AS NEXT STEPS?

Long-Term:
Use this study to call more attention and investments for quality homes, including foundations, particularly for incremental builders.

Who can potentially take this forward?

Regional, provincial or local **Disaster Resilience programs or government agencies** with focus on strengthening awareness and approaches to improve community, household and individual resilience against natural disasters.

Housing agencies such as DSHUD and HUDO whose main mandate is to solve the housing needs of communities, including the overall quality of homes and **NEDA** for crafting policy briefs to push this solution forward.

Financing institutions who see value in offering retrofit foundation solutions to their members or targeted communities in need to better improve housing resilience.

What will the Terwilliger Center Contribute to scale this solution?

- **Technical adviser** to potential implementers of the solution
- **Promotion and publication** of future research to a wider audience
- Facilitate **learning visits** to pilot locations
- Provide **insights about behaviors and practices** of homeowners incrementally building

Thank you

Read more on the state of **foundationless homes in Cebu**

Read more on the **Beam Monolith's Proof of Concept**

Learn more about **Terwilliger Center for Innovation in Shelter**